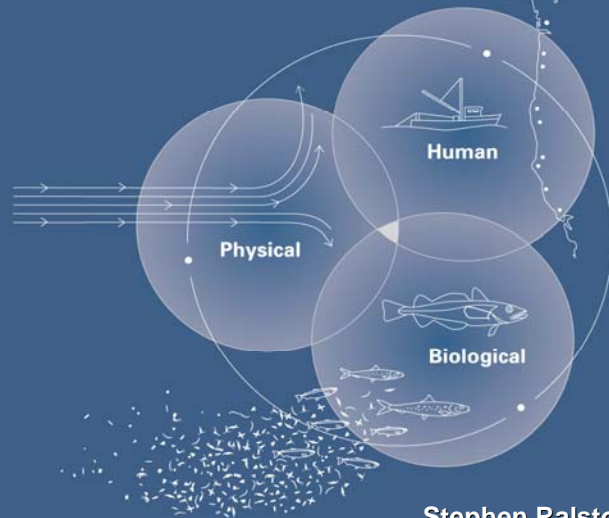


Groundfish Ecology and Management in the California Current Ecosystem

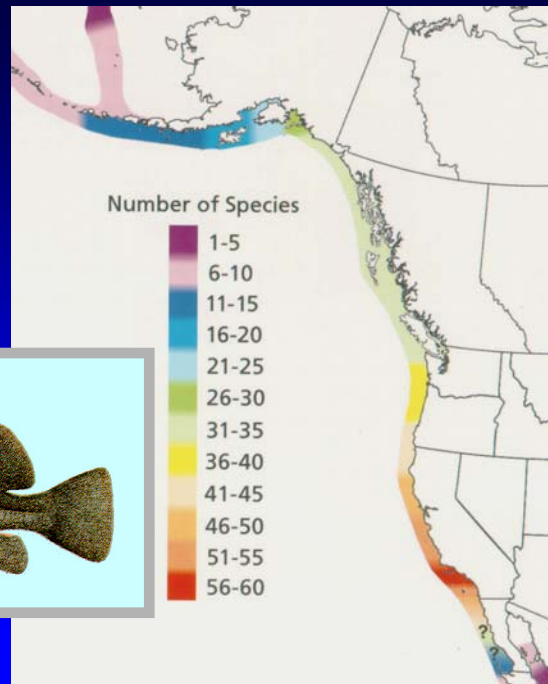
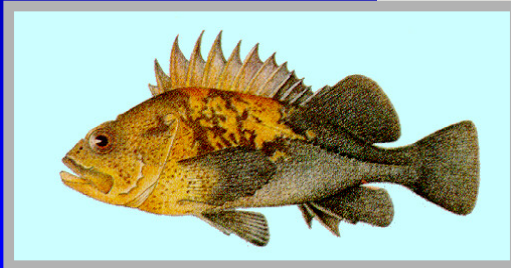


Stephen Ralston and John Field,
Fisheries Ecology Division/SWFSC/NOAA

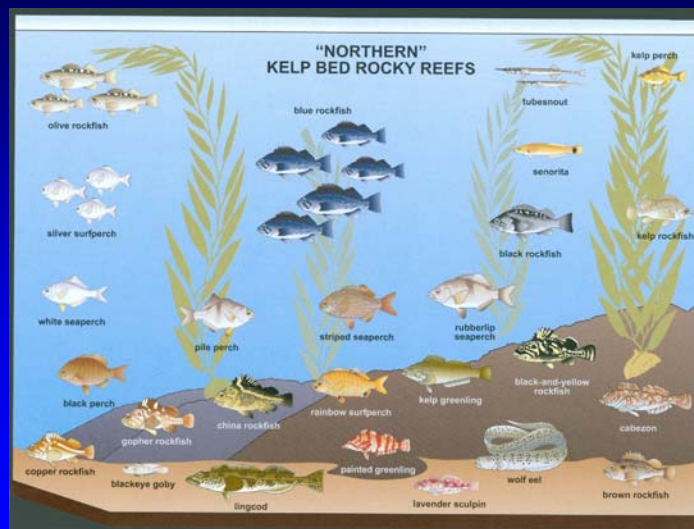
Outline

- Basic ecology and life history considerations for West Coast groundfish
- Trends towards spatially-explicit management by the PFM
- Ecosystem based fisheries management
- Some specifics about fish distributions in the California north-central region

Rockfish species richness (Love *et al.* 2002)

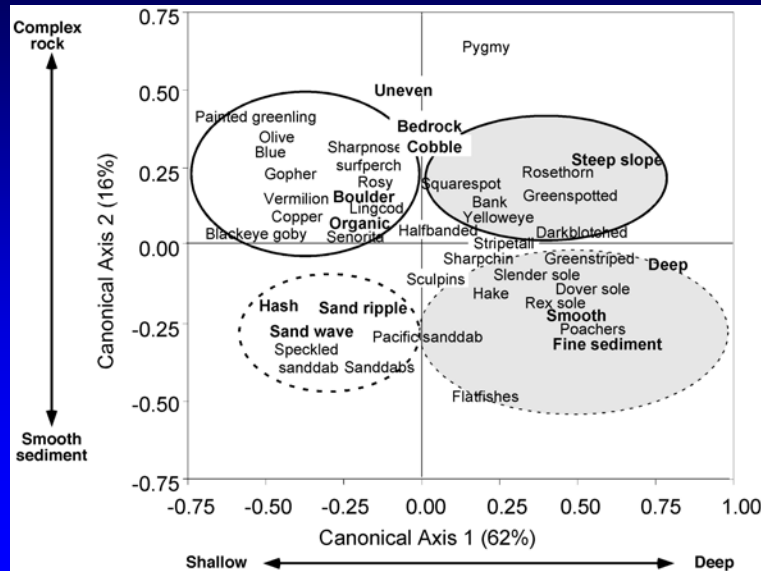


Characteristic fish assemblages are found in different habitats/depths



From: Allen, Pondella, and Horn (2006)

Community structure also depends on bottom complexity



Many West Coast rockfish are highly vulnerable to overexploitation



Low natural mortality = extreme longevity (150-200 years for some species)

Slow growth and late age at maturity (10 to 20 years for many species)

High recruitment variability, some populations have strong year classes only every 10-20 years

Big (44 in), old (ca.100 y), fat (60 lb.), fecund female shortraker rockfish (*Sebastes borealis*) taken off Alaska

Fisheries often disproportionately impact high trophic level predators in benthic ecosystems



A 54 pound lingcod taken in Monterey in the 1950s had an 18½ inch canary and a 12 inch starry rockfish in its stomach.

A 130 pound halibut taken off Oregon in 1915 had eaten a hake, a coho salmon and a yelloweye rockfish that weighed a total of nearly 30lbs



Photo from M. Yoklavich

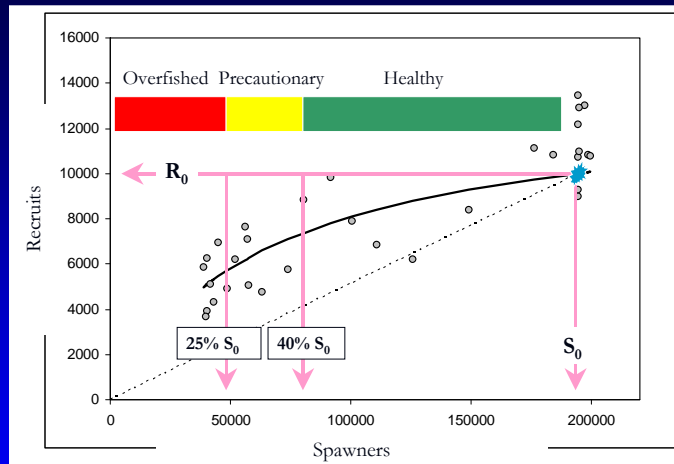
Three of the seven overfished *Sebastes* species in the California Current are high trophic level piscivores (cowcod, bocaccio and yelloweye)

Anecdotal evidence suggests that we may be changing the community composition of many rocky reef habitats...



Harvest of larger, predatory species has the potential to alter community structure, favoring small "dwarf" or diminutive species.

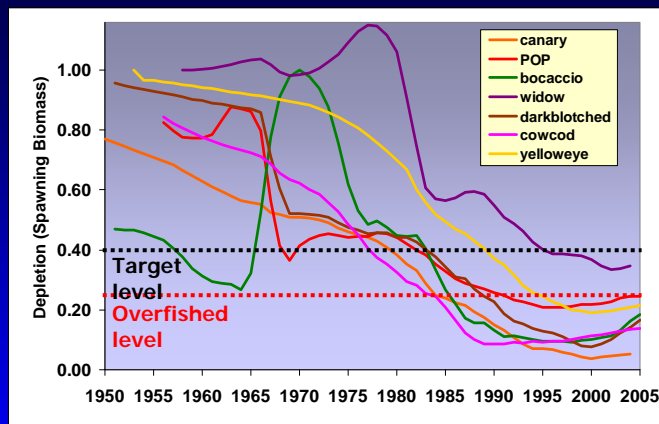
Management targets and thresholds



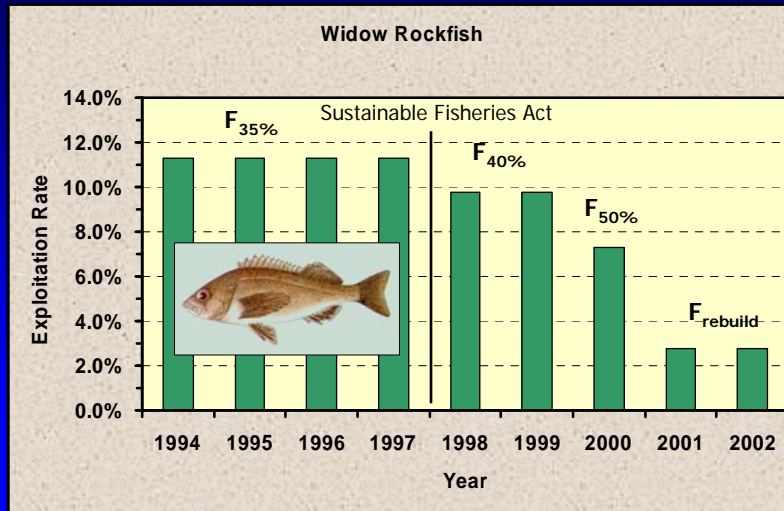
National Standard 1 states

"Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry."

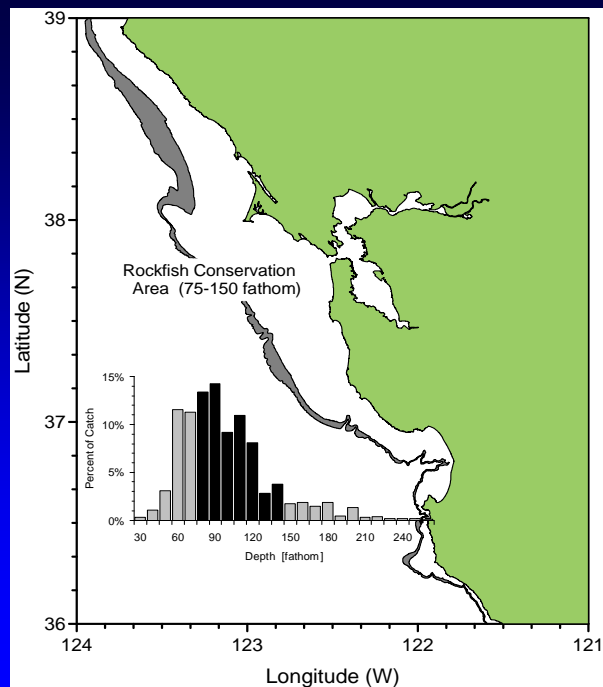
Overfished Groundfish and Their Recovery

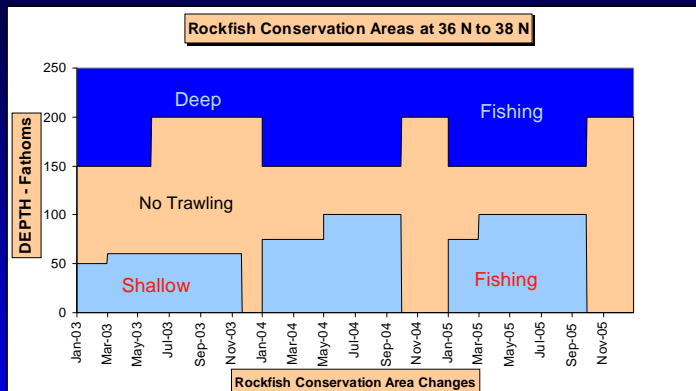


Exploitation rates of rebuilding species have been drastically reduced



RCAs off of Central California- a narrow spatial band, but effective at protecting the majority of the rockfish biomass

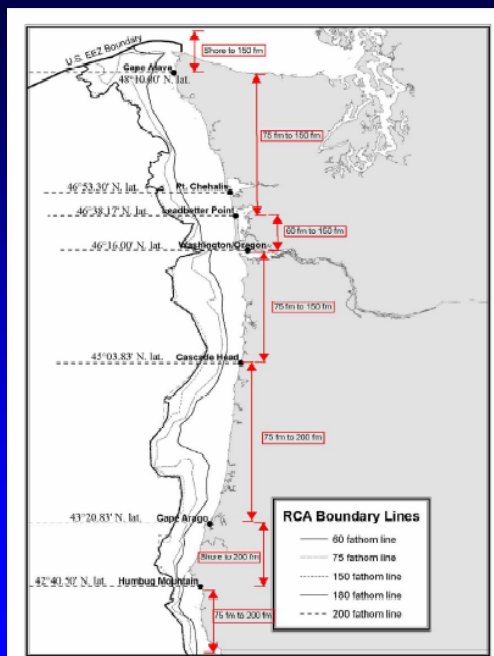




Spatial management measures, gear restrictions and improved catch accounting have been used to minimize bycatch of depleted species

One unfortunate side effect, such actions have also complicated the ability to monitor stock status and trends with catch data

Figures from J. Mason, ERD



Increasing resolution of spatial management measures has been typical of recent management actions

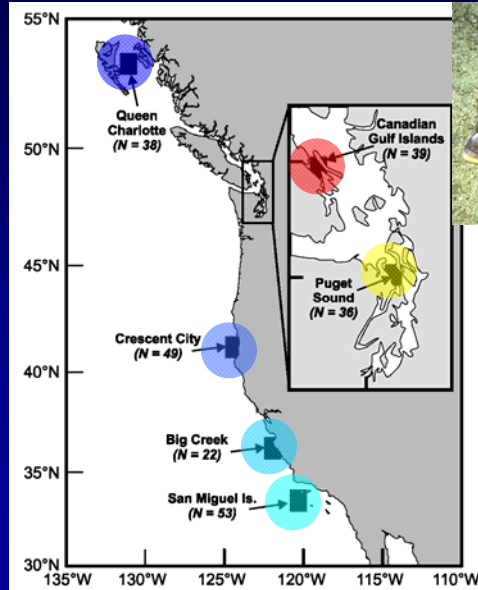
Challenges are many, primarily data limitations but also including a lack of understanding of causality

Figure from GMT report to PFMC March 2007

Population structure in Copper rockfish

3 population subdivisions between Puget Sound and Pacific Coast, with a genetic gradient along the open coast:

identified from microsatellite DNA at 6 loci



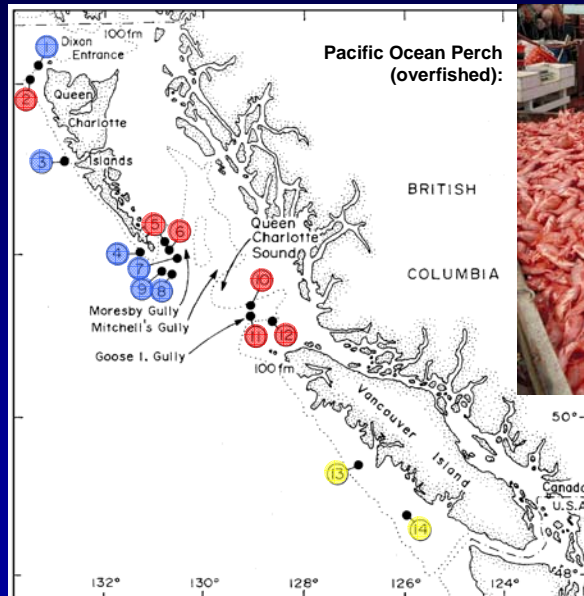
Copper Rockfish

Buonaccorsi et al. (2002)

Population structure in Pacific Ocean perch

3 population subdivisions off British Columbia:

identified from microsatellite DNA at 5 loci

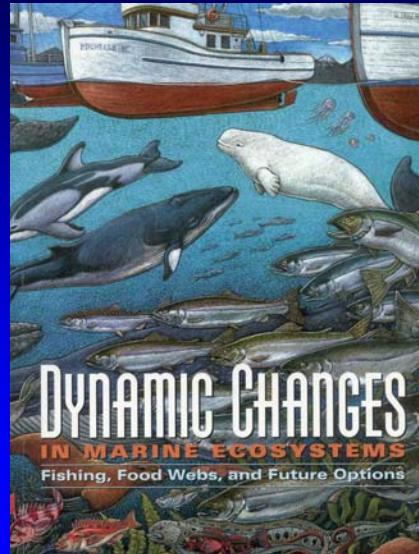
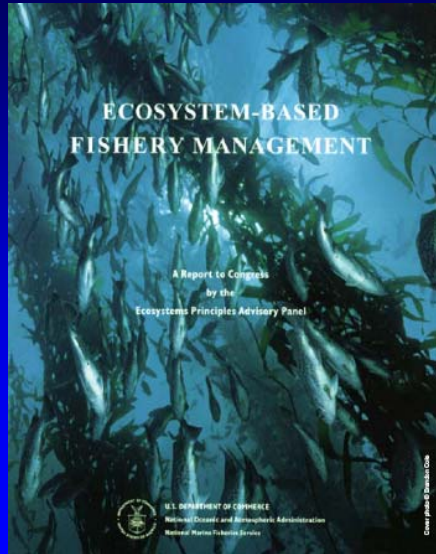


Pacific Ocean Perch (overfished):



Withler et al. (2001)

Ecosystem Based Fishery Management

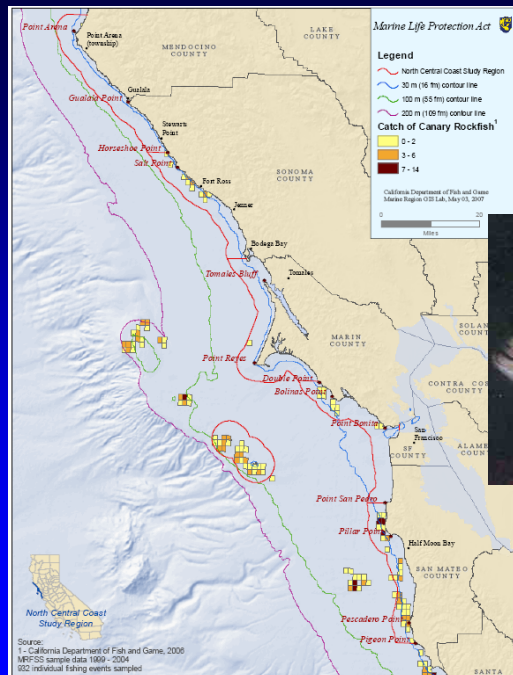
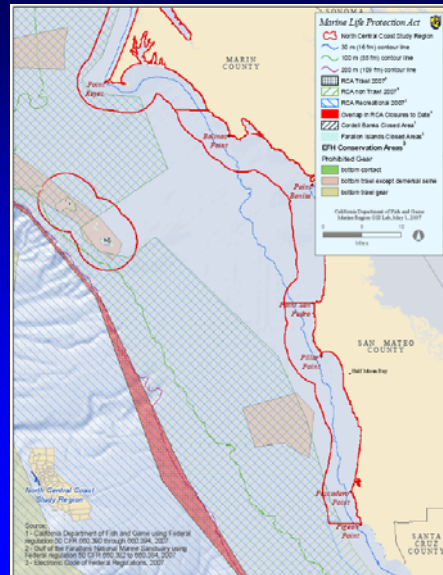
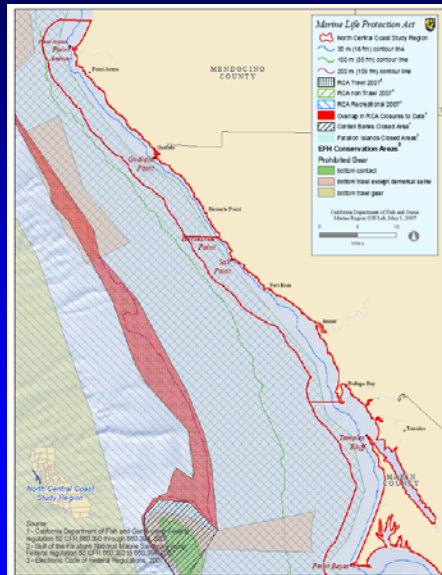


Ten Commandments of Ecosystem-Based Fishery Science

- Keep a perspective that is holistic, risk-averse, and adaptive.
- Question key assumptions, no matter how basic.
- Maintain old-growth age structure in fish populations.
- Characterize and maintain the natural spatial structure of fish stocks.
- Characterize and maintain viable fish habitats.
- Characterize and maintain ecosystem resilience.
- Identify and maintain critical food web connections.
- Account for ecosystem change through time.
- Account for evolutionary change caused by fishing.
- Implement an approach that is integrated, interdisciplinary, and inclusive.

Francis *et al.* 2007

Some North-Central Region Specifics



Canary Rockfish



